

CERTIFICATE OF TRANSMISSION BY FACSIMILE (37 CFR 1.8)

Applicant(s): Ricardo V. Martija et al

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Invention: Method and System for Determining Geographical Regions of Hosts in a Network

I hereby certify that this

Exhibit I (9 pages)

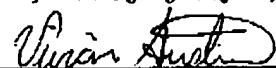
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```
#!/usr/local/bin/perl
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#
# $Id: getCovar.pl,v 1.2 1999/05/25 15:33:47 rmartija Exp rmartija $
#
#  
  
undef;
require 'getopts.pl';
require '/u/rmartija/netsizer/scripts/math.pl';

$USAGE = "Usage: " . $0 . " [-D] -d domain file\n\n".
        "Options:\n".
        "  -D      debug mode\n".
        "  -d domain  domain type (1=US, 2=Non-US)\n".
        "  file    name of input file. The default is STDIN.\n\n".
        "Example: .
        "  $0 ./data/test.out\n".
        "  $0 -d 1 ./data/test.out\n".
        "  $0 -D ./data/test.out\n".
        "  $0 -D -d2 ./data/test.out\n\n";

#####
##### main program #####
#####

$x = &Getopts( 'd:D' );
die "$USAGE\n" unless ($x ne '');

die "$USAGE\n" unless $opt_d && $opt_d >= 1 && $opt_d <= 2;

if( $opt_d == 1 ) {
    $domain = 'US';
}
else {
    $domain = 'NONUS';
}

$oldLoc = '';
$rows = 0;
$cols = 0;

die "$USAGE\n" if( $#ARGV > 0 );

if( $#ARGV < 0 || $ARGV[0] eq '-' ) {
    $INPUT = STDIN;
}
else {
```

```
die "ERROR: cannot open $ARGV[0]\n" unless -r $ARGV[0];
open( INPUT, "< $ARGV[0]" );
$INPUT = INPUT;
}

while( <$INPUT> ) {
    chop;
    next unless length($_) > 0;
    @tokens = split( '\t', $_ );
    $locale = $tokens[0];

    if( $locale ne $oldLoc ) {
        if( $oldLoc ne '' ) {
            %m = &getMeans( $rows-1, $cols, *matrix );
            print "$domain: $oldLoc\n";
            print "MEAN: ";
            for( $i = 1; $i <= $cols; $i++ ) {
                printf "%2.2f", $m{$i} ;
                print " " if( $i < $cols );
                print "\n" if( $i == $cols );
            }
        }

        if( $opt_D ) {
            print "ORIGINAL MATRIX:\n";
            for( $i = 1; $i <= $cols; $i++ ) {
                for( $j = 1; $j <= $cols; $j++ ) {
                    printf "%12.2f", $matrix{$j + ((($i - 1) * $cols))} ;
                    print " " if( $j < $cols );
                    print "\n" if( $j == $cols );
                }
            }
            print "\n";
        }
    }

    %s = &getCovarianceMatrix( $rows-1, $cols, *matrix, *m );
    if( $opt_D ) {
        print "COVARIANCE MATRIX:\n";
        for( $i = 1; $i <= $cols; $i++ ) {
            for( $j = 1; $j <= $cols; $j++ ) {
                printf "%12.2f", $s{$j + ((($i - 1) * $cols))} ;
                print " " if( $j < $cols );
                print "\n" if( $j == $cols );
            }
        }
        print "\n";
    }

    %I = &getInverseMatrix( $cols, *S );
    print "INVERSE OF COVARIANCE MATRIX:\n";
    for( $i = 1; $i <= $cols; $i++ ) {
        for( $j = 1; $j <= $cols; $j++ ) {
            printf "%12.2f", $I{$j + ((($i - 1) * $cols))} ;
            print " " if( $j < $cols );
            print "\n" if( $j == $cols );
        }
    }
    print "\n";
}
```

```
    }

    $oldLoc = $locale;
    $rows = 1;
    $cols = @tokens - 1;
}

for( $j = 1; $j <= $cols; $j++ ) {
    $matrix{ $j + (( $rows - 1 ) * $cols) } = $tokens[ $j ] * 1.0;
}

$rows++;

}

close( $INPUT ) unless $#ARGV < 0 || $ARGV[0] eq '-';

%m = &getMeans( $rows-1, $cols, *matrix );
print "$domain: $oldLoc\n";
print "MEAN: ";
for( $i = 1; $i <= $cols; $i++ ) {
    printf "%2f", $m{ $i };
    print " " if( $i < $cols );
    print "\n" if( $i == $cols );
}

if( $opt_D ) {
    print "ORIGINAL MATRIX:\n";
    for( $i = 1; $i <= $cols; $i++ ) {
        for( $j = 1; $j <= $cols; $j++ ) {
            printf "%12.2f", $matrix{ $j + (( $i - 1 ) * $cols) } ;
            print " " if( $j < $cols );
            print "\n" if( $j == $cols );
        }
    }
    print "\n";
}

%S = &getCovarianceMatrix( $rows-1, $cols, *matrix, *m );
if( $opt_D ) {
    print "COVARIANCE:\n";
    for( $i = 1; $i <= $cols; $i++ ) {
        for( $j = 1; $j <= $cols; $j++ ) {
            printf "%12.2f", $S{ $j + (( $i - 1 ) * $cols) } ;
            print " " if( $j < $cols );
            print "\n" if( $j == $cols );
        }
    }
    print "\n";
}

%I = &getInverseMatrix( $cols, *S );
print "INVERSE OF COVARIANCE MATRIX:\n";
for( $i = 1; $i <= $cols; $i++ ) {
    for( $j = 1; $j <= $cols; $j++ ) {
        printf "%12.2f", $I{ $j + (( $i - 1 ) * $cols) } ;
        print " " if( $j < $cols );
        print "\n" if( $j == $cols );
```

Exhibit II

```
#!/usr/local/bin/perl
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#
# $Id: getHostLoc.pl,v 1.1 1999/05/20 22:27:07 rmartija Exp rmartija $
#
require 'getopts.pl' ;

undef;

$USAGE = "Usage: " . $0 . " [-D] -u file -m file\n" .
"Flags:\n" .
"  -D      debug mode\n" .
"  -u file  file containing the list of unclassified IP\n" .
"           addresses (i.e. those with unknown locations)\n" .
"           and their characteristics.\n" .
"  -m file  file containing the means and inverse of covariance\n" .
"           matrices\n" .
"Examples:\n" .
"  $0 -u unknowns -m matrix" ;

*g_means = ();
*g_inverse = ();
@g_locales;
$g_debug;
$g_attributes;

#-----
#-----
sub getDistance {
    my( $loc, $data ) = @_;
    my( @X ) = @$data;
    my( @mu ) = @{$g_means{$loc}};
    my( @sigma ) = @{$g_inverse{$loc}};
    my( @diff, @prod );
    my( $i, $j );
    for( $i = 0; $i <= $g_attributes; $i++ ) {
        $diff[$i] = $mu[$i] - $X[$i];
    }
    #
    # compute diff(transpose) * sigma. diff(transpose) is a 1 x N matrix
    # and sigma is a N x N matrix. the result is a 1 x N matrix.
}
```

```
#  
for( $i = 0; $i <= $g_attributes; $i++ ) {  
    $prod[$i] = 0.;  
    for( $j = 0; $j <= $g_attributes; $j++ ) {  
        $prod[$i] += $diff[$j] * $sigma[$i][$j];  
    }  
}  
  
#  
# multiply the matrix obtained above, i.e prod, with diff. prod is a  
# a 1 x N matrix and diff is a N x 1 matrix. the result is a scalar.  
#  
my( $dist ) = 0;  
for( $i = 0; $i <= $g_attributes; $i++ ) {  
    $dist += $prod[$i] * $diff[$i];  
}  
  
return $dist;  
}  
  
-----  
#-----  
#-----  
sub readMeansAndMatrices {  
    my( $file ) = @_;  
  
    open( F, "< $file" );  
    @lines = <F>;  
    close( F );  
  
    my( $n_rows, $cur_row, $line_num ) = (-1, 0, 0);  
    my( $cur_loc, $n_means );  
  
    foreach( @lines ) {  
        chop;  
  
        $line_num++;  
  
        next if $_ =~ /^\s*$/; # skip blank lines  
  
        if( $_ =~ /^US.*:\s*(.*)/ ) {  
            die "ERROR: $file is corrupted\n-> line $line_num: $_\n"  
                unless $n_rows < 0;  
  
            # $1 contains the state string (e.g. NJ)  
            $cur_loc = "$1,US";  
            $cur_row = 0;  
        }  
        elsif( $_ =~ ^NONUS.*:\s*(.*)/ ) {  
            die "ERROR: $file is corrupted\n-> line $line_num: $_\n"  
                unless $n_rows < 0;  
  
            # $1 contains the country string (e.g. BE)  
            $cur_loc = "$1,$1";  
            $cur_row = 0;  
        }  
        elsif( $_ =~ ^MEAN.*:\s*(.*)/ ) {
```

```
die "ERROR: $file is corrupted\n-> line $line_num: $_\n"
unless $n_rows < 0;

# $1 contains something like 18.43 1130.71 20.00 170.71 19.57 228.5
my( @means ) = split( ' ', $1 );
$n_means = $n_rows = $#means;
$g_means{ $cur_loc } = \@means;
}
elsif( $_ =~ /INVERSE.*:\s*(.*)/ ) {
    die "ERROR: $file is corrupted\n-> line $line_num: $_\n"
        unless $cur_row == 0;
}
elsif( $_ =~ /([A-Za-z]+).*/ ) {
    die "ERROR: Invalid Tag in $file\n-> line $line_num: $_\n";
}
else {
    my( @row ) = split( ' ', $_ );

    # make sure the matrix is a $n_means X $n_means array
    die "ERROR: $file is corrupted\n-> line $line_num: $_\n"
        unless $#row == $n_means && $cur_row <= $n_means;

    my( $r_entry ) = [@row];
    push( @{$g_inverse{ $cur_loc }}, $r_entry );

    $cur_row++;
    $n_rows--;
}
}

die "ERROR: $file is corrupted. More data expected.\n" unless $n_rows < 0;

@g_locales = keys %g_means;
return $n_means;
}

#-----
#-----
#-----  

sub classifyIPs {
    my( $file ) = @_;

    open( F, "< $file" );

    my( @data, $tloc, $loc, $dist, $min );

    while( <F> ) {
        chop;
        next unless $_ =~ /(\d+)\.(\d+)\.(\d+)\.(\d+).*\s*(.*)/;

        ($ip, @data) = split( ' ' );

        next unless $#data == $g_attributes;

        $min = time;    # initialize $dist to some arbitrary large number
                        # such as the number of seconds since 1/1/1970
    }
}
```

```
foreach $tloc ( @g_locales ) {
    $dist{$tloc} = &getDistance( $tloc, \@data );
    if( $dist{$tloc} < $min ) {
        $min = $dist{$tloc};
        $loc = $tloc;
    }
}

if( $g_debug ) {
    foreach $key (sort keys %dist) {
        printf "%-15s %-8s %7.2f\n", $ip, $key, $dist{$key};
    }
}

printf "%-15s %-8s\n", $ip, $loc;
}

close( F );
}

#####
##### main program #####
#####

$x = &Getopts( 'u:m:D' );
die "$USAGE\n" unless ($x ne '');
die "$USAGE\n" unless ($opt_u && $opt_m);

die "ERROR: cannot open $opt_u\n" unless -e $opt_u;
die "ERROR: cannot open $opt_m\n" unless -e $opt_m;

$g_debug = 1 if( $opt_D );
$g_attributes = &readMeansAndMatrices( $opt_m );
&classifyIPs( $opt_u );
```



```
return 1 if( ! (-e $file || -d $file) );
my( $msg ) = "$file exists. Overwrite";
return 1 if( &prompt($msg, "Y/N", "Y", 1) eq "Y" );
return 0;
}

#####
##### main program #####
#####

$x = &Getopts( 'd:h:p:t:D' );
die "$USAGE\n" unless ($x ne '');

die "ERROR: cannot open $opt_d\n" unless -r $opt_d;
die "ERROR: cannot open $opt_h\n" unless -r $opt_h;
die "ERROR: domain type not specified\n$USAGE\n" unless $opt_t;

die "ERROR: invalid domain type ($opt_t)\n$USAGE\n"
unless (int($opt_t) >= 1 && int($opt_t) <= 3);

chop( $basket = `basename $opt_d` );
open( F, "< $opt_d" );
@domains = <F>;
close( F );

unlink "$opt_p/$basket" unless $opt_t == 3;
foreach $domainName (@domains) {
    chop( $domainName );
    $cmd = "grep '\$\domainName\$\' $opt_h | cut -d\":\" -f1" ;
    if( $opt_t == 3 ) {
        $cmd .= "> $opt_p/$domainName" ;
    }
    else {
        $cmd .= ">> $opt_p/$basket" ;
    }
}
`$cmd`;
```